IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Before the Board of Patent Appeals and Interferences

AF/1753

In re Patent Application of: ROHR et al
Serial No. 09/955,297
Filed: September 19, 2001
Title: PHOTOVOLTAIC DEVICE

Atty Dkt. 550-269
C# M#
TC/A.U.: 1753
Examiner: Brian Mutschler
Date: October 7, 2005

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

☐ **Correspondence Address Indication Form Attached.**

☐ **NOTICE OF APPEAL**
Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the Examiner twice/finally rejecting applicant's claim(s). $500.00 (1401)/$250.00 (2401) $

☐ An appeal **BRIEF** is attached in the pending appeal of the above-identified application $500.00 (1402)/$250.00 (2402) $

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☒ A supplemental reply brief is attached. **(no fee)**

☐ Petition is hereby made to extend the current due date so as to cover the filing date of this paper and attachment(s)
One Month Extension $120.00 (1251)/$60.00 (2251)
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Any future submission requiring an extension of time is hereby stated to include a petition for such time extension. The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our **Account No. 14-1140.** A duplicate copy of this sheet is attached.

901 North Glebe Road, 11th Floor
Arlington, Virginia 22203-1808
Telephone: (703) 816-4000
Facsimile: (703) 816-4100
SCS:kmm

NIXON & VANDERHYE P.C.
By Atty: Stanley C. Spooner, Reg. No. 27,393

Signature: _____

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In re Patent Application of

ROHR et al — Atty. Ref.: 550-269

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SUPPLEMENTAL REPLY BRIEF PURSUANT TO 37 CFR §41.50(A)(2)(ii)

The present Supplemental Reply Brief is responsive to the Supplemental Examiner's Answer mailed August 9, 2005 and the Board of Patent Appeals and Interferences Remand to the Examiner mailed May 31, 2005.

In view of the Examiner's failure to completely respond to the Board's Remand requirements, Appellant requests that the present appeal be maintained (pursuant to 37 CFR §41.50(A)(2)(ii)) and that the issues be promptly considered by the Board and a decision based thereon forwarded to the Appellant.

REMAND FROM THE BOARD

Appellant appreciates the Board's remand of this appeal to the Examiner for consideration and/or clarification of his previous comments. Specifically, the Board

required that the Examiner must: (A) clarify "whether the above noted exhibit [Exhibit I attached to the Reply Brief] has been entered and considered along with the reply brief attached thereto; (B) "reconsider each of the Reply Brief arguments, and, if these arguments are regarded as unpersuasive, must provide the application file record with a complete explanation of why these arguments are thought to be not convincing;" and (C) "a rebuttal of the appellant's arguments concerning the Anderson declaration of record as well as the Reply Brief exhibit (if entered)." (Remand to the Examiner Decision, page 3).

APPELLANTS' REPLY BRIEF PURSUANT TO 37 CFR 1.41.41(b)

A. The noted Exhibit has been entered and considered along with the reply brief

In the Supplemental Examiner's Answer at page 2, line 5, the Examiner states that ". . . EXHIBIT 1 in the reply brief has been entered and considered." Thus the reply brief and the attached Exhibit I are believed to be part of the record of this Appeal.

B. The Examiner's failure to provide a complete explanation of why the Reply Brief arguments "are thought to be not convincing,"

The Examiners arguments in the Supplemental Examiner's Answer supposedly are directed to each of the four sections of Appellants new points of argument set out in the Reply Brief filed November 22, 2004. The Board mandated that such discussion be "a complete explanation of why these arguments are thought not to be convincing."

Yet, in each of the four sections of the Supplemental Examiner's Answer, the Examiner, apparently realizing that he has no evidentiary support for his positions, raises

a new issue and suggests that the cited prior art reference Ekins-Daukes et al., Applied Physics Letters, Vol. 75, No. 26 December 27, 1999 ("EDI" as there is another Ekins-Daukes reference of record) "inherently" contains the alleged missing teachings (See the Supplemental Examiner's Answer in section (1), page 3, line 16; section (2), page 4, line 9; section (3), page 5, line 6; and section (4), page 6, line 3).

In accordance with the Manual of Patent Examining Procedure, if an examiner raises an allegation of "inherency," the applicant may traverse the allegation thus forcing the Examiner to cite a reference supporting his position ("If the applicant traverses such an assertion the examiner should cite a reference in support of his or her position." MPEP §2144.03). Since this issue has never been raised before in any rejection, no opportunity has been provided during prosecution for Appellant to require the Examiner to support his position.

Since this application was filed more than 5 years ago, Appellant's respectfully submit that a further remand to the Examiner (for support of his "inherency" arguments) is not needed as the Board mandated that the Examiner, in the Supplemental Examiner's Answer, provide "a complete explanation" and the failure to provide any support for the "inherency" position is an admission that there is no support. Thus, the Examiner's failure to meet his duty to provide evidentiary support, if any, for his "inherency" theory in the Supplementary Examiner's Answer, means that no remand is needed (which further remand would additionally delay consideration of the merits of this appeal).

1. Rebuttal to Examiners comments on "Strain is not the same as stress"

On page 2, under the caption "1. Response to Appellant's argument that strain is not the same as stress", the Examiner states many of Appellants arguments and then admits that "Appellant's arguments are well taken." By this admission, he presumably agrees with each of the Appellant arguments previously stated, i.e., that "strain is not the same as stress" and that "it is incorrect to say that because Ekins-Daukes et al suggest that the strain in a period be minimized, stress in the period must also be minimized" and "if two materials have different Hooks [sic] law constants k, i.e., k_1, k_2, and if those materials are strained the same amount due to a difference in Hooks [sic] law constant, the resultant stress will be different."

However, against this background of admissions that Appellant's arguments are, in fact, correct, the Examiner, at the bottom of page 2 of the Supplemental Examiner's Answer, makes the incredible statement that

> "Appellant has not shown there would be a substantial difference in Hooks [sic] law constant for the GaAs, $GaAs_{0.939}P_{0.061}$ barrier and $In_{0.17}Ga_{0.83}As$ well so that there would be substantial shear force."

Firstly, this is a completely new allegation by the Examiner and should not be the basis for a rejection. Rather, the Examiner's admission that "strain is not the same as stress" should be taken as fact in view of the admission.

Secondly, it is known that alternating barriers and wells have bigger and smaller lattice constants. This is known both from Appellant's specification, page 3, lines 4-7, and from reviewing the cited EDI. Three lines from the bottom of the first column on page 4195 of EDI states "a_{InGaAs}" and "a_{GaAsP}" are the respective well and barrier lattice

constants." As is well known to those of ordinary skill in the art, if the lattice constants were the same, there would be no need for these terms in cited "equation (1)."

Thirdly, the Examiner has adduced no evidence of record tending to establish that the barrier and well would have the same lattice constants (as apparently contended by the Examiner) and the Appellants specification and the cited EDI reference both teach that the lattice constants of barriers and wells are different. As discussed in Appellant's specification (and as is well known to those of ordinary skill in the art), any difference in the lattice-constants of the well and barrier is sufficient to cause a net difference in shear force (unless the thickness of the layers is adjusted as set out in the present application).

While the net shear force of one barrier/well combination of layers may be small, as the number of layers increases, the net shear force increases as well. As discussed in EDI, dislocations compromise the open circuit voltage generation of the Multi-Quantum-Well ("MQW") cells ("However, the lattice mismatch places an upper limit on the number of QWs that can be accommodated before strain relaxation takes place." EDI page 4195, col. 1, lines 12-14). While strain is accommodated and averaged to be minimal in ED1, the net difference in shear force (the stress resulting from differences in lattice constants in the barrier and well layers) is not. As set out in the Freundlich reference, beyond about 20 layers, the net shear force (the sum of the individual shear force in a period or barrier/well combination) becomes so large that dislocations occur (Specification, sentence bridging pages 2-3).

As a result, an increasing net shear force (caused by a given shear force for a single barrier/well combination which then increases as the number of barrier/well layers

are increased will result in dislocations. As dislocations reduce the efficiency of the MQW cell, such dislocations are to be avoided if possible. EDI, the primarily cited prior art reference, teaches that strain-balancing the layers, which on average are lattice-matched to the substrate, can reduce dislocations.

It should be noted that the MQW cell of EDI, which used the maximum of 20 periods (barrier/well combinations), did not provide even the measured efficiency of the GaAs control cell with which it was compared (See Tables I and II on pages 4196 and 4197).

Subsequent to the publication of EDI, Appellant, as well as Dr. Anderson, found that using the strain-balanced approach in EDI was "insufficiently exact" to achieve zero stress and thereby prevent the efficiency robbing dislocations. However, Appellant found that the zero-stress system of the present invention permits a much larger numbers of layers (thereby increasing efficiency) with substantially no shear force, thereby preventing dislocations which limited MQW cell efficiencies.

Thus, the Examiner's statement that "Appellant has not shown that there would be a substantial difference in Hooks law constant . . . " is simply not true, as, the only evidence of record states the contrary, both in Appellant's specification and in EDI, the primarily cited prior art reference.

2. Rebuttal to Examiner's comments on claim requirement of "substantially no shear force"

The Examiner's arguments on this section actually cover several Reply Brief arguments and will be taken in turn.

Firstly, the Examiner states on page 3, lines 14-17 of the Supplementary Examiner's Answer, that:

> "it is the examiner's position that Ekins-Daukes et al's multiquantum well $GaAs_{0.939}P_{0.061}$ $In_{017}Ga_{0.83}As$ on GaAs substrate **inherently** has zero-stress condition or substantially zero stress, and thus, there will be substantially no shear force as here claimed." (emphasis added)

Secondly, on page 4, lines 8-10 of the Supplementary Examiner's Answer, the unsupported allegation is made by the Examiner that:

> ". . . Ekins-Daukes et al's multiquantum well $GaAs_{0.939}P_{0.061}$ and $In_{0.17}Ga_{0.83}As$ on GaAs substrate **inherently** has the claimed property of substantially no shear force on a neighboring structure." (emphasis added)

The Examiner is completely incorrect in these assessments. The issues of "inherency" have not been previously raised nor has the Examiner offered any evidentiary support for this claim.

Moreover, these allegations are incorrect in view of the evidentiary statements set out both in Appellant's specification (paragraph bridging pages 2-3) and in the Declaration of Dr. Anderson (who states in paragraph 12 that the teaching in Ekins-Daukes I, even though the thickness weighted average lattice constant of the wells and barriers is roughly the same as the substrate, "this is insufficiently exact to ensure periods which exert 'substantially no shear force on an neighboring structure'."). The dislocations caused by non-zero shear force on the neighboring structures comprise the problem in the prior art EDI reference which is solved by the claimed invention (see Appellant's specification as originally filed, page 2, line 30 through page 3, line 7).

The Examiner appears to admit the lack of identicality in the lattice constants of the barriers and wells in the sentence bridging pages 3 and 4 (of the Supplemental Examiner's Answer), where he suggests that the lattice constant for GaAs substrate "is very close to the lattice constant a_1 and a_2"for the barrier and the quantum well and thus "are very close to or essentially zero." The Examiner's unsupported allegations of inherency do not overcome Appellant's evidence contained both in the specification and in the Anderson Declaration which confirm that the lattice constants for the barrier and well are not identical, and the strain-balancing method of EDI is "insufficiently exact," and thus the ED1 disclosure of zero strain does not suggest or teach "substantially no shear force on a neighboring structure."

3. Rebuttal to Examiner's comments on "A zero strain configuration as taught in Ekins-Daukes I is not the same as a substantially zero stress combination"

On page 5, lines 5-7 of the Supplemental Examiner's Answer, the Examiner states:

> "As noted above, it is the Examiner's position that Ekins-Daukes et al's multiquantum well $GaAs_{0.939}P_{0.061}$ and $In_{0.17}Ga_{0.83}As$ on GaAs substrate **inherently** has the claimed property of substantially no shear force on a neighboring structure." (emphasis added)

The fallacies of the Examiner's argument and conclusion are the same as that discussed in subsection (2) above and Appellant's response is herein incorporated by reference.

The Supplemental Examiner's Answer also raises a "straw man" argument that the Exhibit I, attached to Appellant's Reply Brief, is not exactly the same as EDI (" . . . nothing in said example in said Appeal Brief or said EXHIBIT 1 reflects the properties or structure of Ekins-Daukes et al's exact device."). Appellants Reply Brief stated that the

Exhibit I "illustrates strain and stress relationships and demonstrates that it is possible to have zero strain and yet substantial stress in the Ekins Daukes I organization of elements."

Appellant's never alleged that Exhibit I was a scale drawing or otherwise identical to EDI nor does it have to be exact to illustrate the principle. Rather, it illustrates how in a MQW, where the lattice constants are different ($k_1>k_2$), a strain balanced system (schematically shown in (a) and (b)), such as that disclosed in EDI ("We report upon a strain-balance approach for enhancing the GaAs solar cell efficiency." EDI, page 4195, col. 1, lines 18-19), can still have a net stress which, as was known, will cause efficiency robbing dislocations. This is contrasted with the present invention (schematically shown in (c) and (d)) and also with ($k_1>k_2$), where, by proper dimensioning of the thickness of the layers, can achieve a net zero or substantially zero stress (or force). The consequence of this zero net force is that MQW with much higher numbers of periods than 20 can be created (and having higher solar energy conversion efficiencies) without incurring the dislocation problem noted in Freundlich and EDI. Since, the solar cell efficiency is a function of the absorption layers, a much more efficient MQW solar cell can be created with the presently claimed invention.

4. Rebuttal to Examiner's comments on "The Examiner has clearly ignored paragraph 12 of Dr. Anderson's Declaration"

The Examiner does not deny that he previously ignored the Declaration evidence of Dr. Anderson (who is with the University of Massachusetts and not associated with the assignee or the inventors of the claimed invention). Instead he attempts to rationalize

such ignorance by stating in the Supplemental Examiner's Answer bridging pages 5-6, that Dr. Anderson's testimony is not deemed to be persuasive

> "because said paragraph 12 does not address the exact solar cell prepared in Ekins-Daukes et al, i.e., the multiquantum well $GaAs_{0.939}P_{0.061}$ and $In_{0.17}Ga_{0.83}As$ on GaAs substrate. As noted above, Ekins-Daukes et al's multiquantum well $GaAs_{0.939}P_{0.061}$ and $In_{0.17}Ga_{0.83}As$ on GaAs substrate **inherently** has the claimed property of substantially no shear force on a neighboring structure." (emphasis added)"

Appellant is at a loss as to what it is about the words "The Ekins-Daukes I disclosure teaches" that the Examiner does not understand. Here, the Declarant has addressed exactly that which is disclosed in EDI.

We have the testimony of Dr. Anderson, an expert in the field, whose statement is that the Ekins-Daukes I reference contain a disclosure which is "insufficiently exact to ensure periods which exert 'substantially no shear force on a neighboring structure'." The Examiner has not questioned the veracity of Dr. Anderson nor the accuracy of his statement. Thus, this evidence should be taken as conclusive of the fact that EDI does not teach or suggest the subject matter of the present application.

C. The Examiner's failure to provide a rebuttal to appellant's arguments concerning the Anderson declaration of record and the entered reply brief

The Remand to the Examiner order specified that the Examiner's "explanation must include a rebuttal of the appellants' arguments concerning the Anderson declaration of record as well as the reply brief exhibit (if entered)." The Examiner has stated that the Exhibit I has been considered and entered. The Examiner's rebuttal to the Anderson

declaration is covered in section B (4) above. The Examiner's rebuttal to the Exhibit I is covered in section B (3) above.

Thus, the Examiner's required rebuttal is believed to be completely responded to in Appellant's Supplemental Reply Brief, section B above.

Summary

In essence, the basis of the Examiner's arguments are that he apparently admits that strain is different from stress, he admits that EDI teaches strain-balancing and can point to no teaching in EDI of zero stress, and that the claims at issue require that the period (of one barrier/well combination) "exerts substantially no shear force on a neighboring structure." To make up for the lack of any teaching of a zero-stress in any prior art reference, the Examiner argues that this must somehow be "inherent" in the EDI teaching, but provides no evidence in support of this conclusion. Even though the declaration of Dr. Anderson specifically states that EDI's teachings are "insufficiently exact" to achieve zero stress, the Examiner disregards the evidence. Exhibit I was attached to the Appellants Reply Brief as an aid to help demonstrate that, where lattice constants are different, having a strain balanced approach, as in EDI, does not necessarily result in a "no shear force" construction as required in the current claims.

In view of the above, and the Appellants Appeal Brief and Reply Brief already of record, the rejection of claims 1-18, 20-27, 31-33 and 35-38 are clearly patentable over the cited prior art, the rejection thereof is clearly in error and reversal by this Honorable Board is respectfully requested.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: _____
Stanley C. Spooner
Reg. No. 27,393

SCS:kmm
901 North Glebe Road, 11th Floor
Arlington, VA 22203-1808
Telephone: (703) 816-4000
Facsimile: (703) 816-4100